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Idaho POTW Draft Permit Review
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Introduction

The following topics will be discussed further in the analysis of the Idaho POTW draft permits and their possible effects on Spokane River water quality:

- PCBs and dioxin controls
    - Biodegradation of PCBs
- Whole Effluent Toxicity
- Increased POTW discharge
    - Year-round discharge
    - Change in summer time dispersal/discharge
- TMDL Completion for Washington and Idaho
- Metals
- Combination of Contaminants

PCBs and 2,3,7,8 TCDD (dioxin)

The three permits require a monitoring program for both PCBS and 2,3,7,8 TCDD, but no permit limits.

The Fact Sheets for all three permits explain the basis for applying monitoring requirements and lack of permit limits for PCBs. Basically, EPA does not have the data to use in calculating the permit limits. There have been no efforts to monitor PCBs in the effluent of these facilities, although EPA describes quite carefully the technical justification for proceeding to require the data in anticipation of setting permit limits. In the absence of permit limits, requiring TMPs, source identification and control, monitoring performance and ambient conditions is the next best approach. These efforts will need to be translated into PCB removal and reduction activities for each facility and the monitoring data used to calculate effluent limits for these facilities.

The background information in each fact sheet gives relevant data on PCB levels in various POTW facilities on the Spokane River and nearby waters. The information provides clear and convincing justification for controlling PCBs in the POTW effluents, including data on effluent PCB levels and ambient, receiving water PCB levels. These data indicate that EPA can conclude with certainty that PCBs are now, and in the expanded facilities will be discharged into the Spokane.

Several lines of evidence and reasoning support the conclusion that PCBs in the discharges of these three facilities will contribute to violating the WQS for PCBs at the

Spokane Tribal border on the Spokane River. First, EPA has demonstrated why the agency concludes that the discharges will contain PCBs. Second, PCBs do not breakdown, weather or biodegrade to any significant degree, and PCBs added to the river will not change substantially in quantity or quality during transit down river. Third, the Spokane River already exceeds the Tribal water quality standard at the Tribal border and additional PCB discharges will add to the total PCB load in the river. Finally, notwithstanding other processes, PCBs added to the Spokane River are lost from the system only via washout in high flow periods or other physical removal (dredging).

The requirement for dioxin monitoring includes only one congener (2,3,7,8 TCDD) of the many congeners of this chemical group that can cause health effects in people and harm to aquatic life and wildlife. The US EPA and World Health Organization recognize that 7 dioxins, 10 furans and 12 PCBs are sufficiently toxic to humans that toxicity equivalency factors (TEFs) have been developed for these congeners (EPA 2010; van den Berg, 2006). The total toxicity needs to be assessed via measurement of all the dioxins and furans with TEFs (see attached list). Without including all the dioxins and furans, a substantial proportion of the total toxicity is likely to be left unaddressed.

The permits require monitoring PCBs in the influent on a bi-monthly basis and monitoring the effluent on a quarterly basis. There are good reasons to monitor both influent and effluent, the influent to conduct a source identification analysis, and the effluent to assess discharge of PCBs to the river. An excellent reason to measure both synoptically is to assess the change in PCBs in the POTW facility, either because the facility is a potential source (leaking equipment or residuals in the facility), or to assess any alteration of PCB composition during the waste processing. The requirement for influent monitoring and TMP development with source identification is consistent with other efforts to remove PCBs from the POTW input streams. But the monitoring will not clearly indicate the extent to which the facility does or does not contribute PCBs to the total discharge unless the influent and effluent are measured within a short period, i.e. during the same 24 hour period. Ideally, the influent-effluent sampling will be conducted as paired samples, with the time between samples set to be the time needed for wastewater to transit through the POTW facility.

The permit will be improved by requiring that the quarterly effluent sampling occur on the same day as the influent sampling for at least two sampling events per year. Similarly, the ambient, instream sampling effort needs to coordinate with the influent and effluent sampling, in the same way that the permit requires coordination with the SRRTTF.

The permits use a PCB source determination "threshold" of 50 ppm that derives from TSCA, passed and signed into law in 1976. This threshold is antiquated and based on insulating oil in transformers, the major PCB reservoir in the US in 1976. In the past 36 years, scientific research on PCB toxicity has advanced substantially (see US EPA IRIS listing and ATSDR Toxicological Profile). As a result, it is clear that the 1976 reference to 50 ppm of PCBs is no longer adequate, protective or sufficient to control sources or protect water quality at the level required in standards in force in 2012. Indeed, the Spokane Tribal water quality standard is 9 orders of magnitude lower than the level set to identify PCB contamination. The 50 ppm level is no longer appropriate or adequate to protect.

The 50 ppm concentration would apply equally to oils from transformers, soil, solid matrices such as caulking and gaskets, any product, as well as sludge in storm sumps and industrial wastes. This 50 ppm level is not sufficiently protective and not appropriately applicable to such a wide range of environmental matrices. Either the 50 ppm value needs to be low enough that any and every source material will be covered in a protective fashion, or EPA needs to develop a table of values according to source type.

The permits require quarterly monitoring of PCB concentrations in influent, effluent and surface waters, in order to provide the data necessary to assess the probability of exceeding the water quality standards. The permit places no quantitative limits (effluent limits) on PCBs in the discharge because of a limitation of data and technical uncertainties. At the same time, the permit allows an increase in total suspended solids (TSS) in light of the higher discharge flows. The higher TSS creates a likely problem with PCB discharges and loadings to the Spokane River. TSS and PCBs are linked because of the affinity of PCBs for suspended particles, especially organic particles. Thus, as the State of Washington has demonstrated in several investigations and reports on PCB loadings to the Spokane, increases in TSS are associated with increased PCB loadings, in all likelihood due to higher level of PCBs adsorbed to the particulate matter in the discharge.

The association of PCBs with particulate matter is uniformly recognized as a property of both wastewater discharges and surface waters (e.g. Delaware River TMDL, DRBC). Reductions in PCB discharges require controlling primary source inputs to the POTW and controlling TSS in the discharge. The former strategy is the only long term approach that ultimately removes PCBs from the system, the latter approach is a short term tactic that can dramatically reduce PCBs in the discharge.

The permit needs to make two changes, at a minimum, to account for the PCB/TSS relationship. First, PCBs need to be measured monthly in order to have the data for both TSS and PCBs in the same samples. Second, permit limits for TSS need to not increase during the winter months until PCB concentrations in the discharge have declined to the point where inputs to each facility have declined. During the initial operating period, TSS controls will help reduce PCBs in the discharges.
In the Fact Sheets for each facility, EPA describes the rationale for permit requirements to monitor PCBs and dioxins.

EPA decided not to set permit limits for PCBs and dioxin(s) at this time, pending the results of monitoring efforts, aimed at demonstrating PCB discharges from each facility into the Spokane River. This process will take some time to generate the data and in the interim, each facility will undertake source identification and reduction measures, In lieu of meeting permit limits. Alternatively, EPA could set permit limits now, including a compliance schedule, and revise the permit limits when the data are available to refine the values. The justification for setting PCB permit limits has been explained in the fact sheet for each facility in the listing of the POTW facilities that discharge PCBs and the concentrations in other facilities. PCBs are so commonly found in POTW discharges that EPA is not likely able to provide a list of facilities that do not discharge PCBs.

The numeric limit for PCBs can be set on the basis of the value necessary to meet the WQS for the Spokane River at the Spokane Tribal border on the river. EPA could apply conservative assumptions of simple mixing and no loss in transit from the Idaho region to the Tribal border. Another option is to set the permit limit at the level of detection for monitoring, as listed in the fact sheet, 10 pg/L.

EPA has available several methods to measure PCBs and dioxins in aquatic samples, and can use high volume sampling to increase the sensitivity of all methods. EPA describes a limitation described in the fact sheets due to the sensitivity of methods, notably that method 1668 is the best and most sensitive method, but EPA is still processing the final approval. This procedural weakness in EPA process is resulting in severe restrictions on the ability of the agency and state agencies to set permit limits and other controls that are adequately protective of human health and the environment.

Whole Effluent Toxicity

The requirements to maintain WET testing on a semi-annual schedule and add a plant to the testing assays (in addition to the fish and invertebrate) is justified and should be maintained. In fact, the WET testing would be vastly improved by requiring two invertebrates: a crustacean and a mollusk and insuring that the WET assay endpoints included reproductive functions and organs.

Based on the Idaho Water Quality Standards, at the point of discharge, the Spokane River is protected for the following designated uses (IDAPA 58.01.02.110.12):

- cold water aquatic life habitat
- salmonid spawning
- primary contact recreation
- domestic water supply

Lacking is the protection of fishing aquatic wildlife, an important aspect to the Spokane tribes.

Fish consumption rates have not been completely updated and revised in Idaho, the state now basing water quality standards on 17.5 g fish/day. The previous consumption rate of 6.5 g/day was used at the time the older WQS for PCBs (the one EPA is using in this case because the new standard of 64pg/L has not yet been approved by EPA) was determined. Thus the PCB standard that applies to these permits, according to the fact sheets and permits is based on the older fish consumption rate of 6.5 g/day.

Biodegradation of PCBs

As a result of their very stable properties, PCBs are synthetic compounds that are not readily degraded and will remain in the aquatic environment largely as released. The degradation of these compounds entails difficult mechanisms of chemical, biochemical or thermal destruction (Erickson, 1986). Biodegradation is the degradation of compounds by bacteria or other microorganisms. It is a slow process but can occur in both aerobic and anaerobic environments. It is the only process known to degrade PCBs in aquatic environments. The specific processes involved are aerobic oxidative dechlorination, or hydrolytic dehalogenation, and anaerobic reductive dechlorination. Theoretically, the biological degradation of PCBs should result in CO2, chlorine and water. This process involves the removal of chlorine from the biphenyl ring followed by cleavage and oxidation of the resulting compound (Boyle et al., 1992). Those compounds with a high degree of chlorination are more resistant to biodegradation and degrade very slowly in the environment.

Aerobic oxidative dehalogenation involves the oxidation of PCBs by aerobic microbes, especially by bacteria of the genus *Pseudomonas*. This process involves the addition of oxygen to the biphenyl ring (Boyle et al., 1992). Further research by Bevinakatti and Ninnekar (1992) also proposed the degradation of biphenyls by the *Micrococcus sp.* The by-products produced, like benzoate, are less toxic compounds to people and the environment (Bevinakatti and Ninnebar, 1992). Since PCBs are more persistent with increasing chlorination of the congener, aerobic biodegradation involving biphenyl ring cleavage, is restricted to the lightly chlorinated congeners (U.S. DHHS, 1992).

Anaerobic reductive dechlorination involves the replacement of chlorine with a hydrogen atom on the biphenyl ring. This type of degradation transforms the more highly chlorinated congeners to less chlorinated ones. Byproducts of this process are less toxic and can usually be degraded by the aerobic microbes (Ye et al., 1992). Different microbes utilize different pathways of dechlorination (Alder et al., 1993). However, the para- and meta-substituted congeners are more commonly degraded than ortho-substituted congeners. Only a few ortho-substituted congeners have been reported to undergo degradation (Fish and Principe, 1994). Anaerobic degradation has most commonly been observed under methanogenic conditions (Alder et al., 1993).

Many environmental factors can affect the degradation of biphenyls, both aerobically and anaerobically. Rates are quite variable depending on the conditions present in the environment. These factors may include: degree of chlorination, concentration of the congener, type of microbial population, available nutrients, pH, and temperature. It has been suggested that both aerobic and anaerobic conditions are affected with the addition of certain nutrients and that biodegradation rates decrease with high levels of organic carbon present (U.S. DHHS, 1992).

The position of chlorine atoms on the rings also affects the rate of biodegradation. Not only are PCBs with para- and meta-substituted rings more easily degraded than the ortho- substituted compounds, but PCBs containing all chlorines on one ring are biodegraded faster than those which contain chlorines throughout both rings.

Other methods of PCB destruction are being used, developed and investigated and include incineration and photolysis. Incineration involves exposing the PCB congeners to extremely high temperatures (1200° C), a mixing/agitation process and a sufficient residence time (Erickson, 1986). Photolysis is a process that uses the free radicals produced from sunlight to remove the chlorine atoms from the biphenyl ring (U.S. DHHS, 1992). However, the UV light can not sufficiently penetrate water at depth to make a major contribution to PCB degradation in the natural environment (Sinkkonen 2000).

Increased POTW Discharge

The Hayden POTW is capable of disposing of 100% of its effluent via land application in the summer. Requesting year-round discharge instead of continuing summer-time dispersal is removal of a beneficial process that can recharge the aquifer and land without use of additional nutrients. Also, the POTW has been expanded to a design flow of 2.4 mgd. However, the design flow of the POTW was 1.65 mgd in 2007, when a draft permit was last issued for public comment but the design flow was 1.5 mgd in 1999, when the most recent final permit was issued. The increase in mgd should be carried through the permit process.

TMDL Completion for Washington and Idaho

There is no complete TMDL for PCBs on the Spokane River in Idaho or Washington. A TMDL will ultimately affect the permit effluent limits, the permit conditions and activities that result in release of PCBs to the Spokane RIver. The advantage of completing and applying a TMDL for PCBs on the Spokane River is developing and implementing an approach for PCBs and TCDD toxic control plan monitoring source identification, the same approach as for the Delaware River for PCBs below Trenton. It is still operative and EPA has deemed it successful. On the Spokane River, there is neither up-to-date permit limits nor a TMDL for either state, leaving the PCB control to an ad hoc approach rather than a comprehensive plan.

Metals

Metals of concern include cadmium, lead, zinc, copper and silver in the POTW permits. Based on Spokane Tribe Water Quality Standards (2003), the permit concentration limits for these contaminants are not likely to be exceeded, even additively (see table below, where Concentration = max. daily limits; and Tribe Water Quality Standards = maximum ambient water concentrations for consumption of both contaminated water and fish or other aquatic organisms).

	Concentration ug/L			Tribe WQS ug/L
	Hayden	CDA	Post Falls	Water + Organisms
Cadmium				
Lead	3.76			
Zinc	112.00	8.42	115.00	3470.00
Copper			27.70	1300.00
Silver		22.50		

Combinations of Contaminants

Under the general conditions of the Spokane Water Quality Standards (2003), "(1) All surface waters shall be free from pollutants and other materials in concentrations or ***combinations*** that do not protect the most sensitive existing or designated use of the water body." However, combinations of contaminants are not described or addressed in the permits. This omission is a major gap in setting protective measures for human health or ecological condition.

The multitude of surface water contaminants was well documented by the US Geological Survey (USGS) that initiated a comprehensive survey of contaminants in surface waters of the US to include chemicals that had not been previously assessed. USGS termed these chemicals "emerging contaminants" and published the results of a survey of 139 locations across the continental US (Kolpin, et al. 2002). The results indicated the widespread occurrence of a range of chemicals in rivers, streams, lakes and ponds. The chemicals include pharmaceuticals (ethinyl estradiol) and industrial chemicals (polychlorinated biphenyls) known to be hormonally active in cell-based or whole animal bioassays.

EPA Request for Comments

EPA is requesting public comment on the following topics for all three Idaho POTWs (Hayden, Coeur d'Alene, and Post Falls):

- The final effluent limitations for total phosphorus, five day carbonaceous biochemical oxygen demand ($CBOD_5$), total suspended solids (TSS), ammonia, lead, zinc and chlorine have been revised (see the revised draft permit at Table 1, Part I.B).
    - o **See PCBs and 2,3,7,8 TCDD (dioxin), pg 3**
    - o **Metals, pg 6**
- The draft permit now includes effluent limits for cadmium.
- The permit allows the permittee to demonstrate compliance with loading (i.e., lb/day) limits for cadmium, lead, and zinc that were specified by the State of Idaho in its draft Clean Water Act Section 401 certification by developing and implementing an offset plan.
- The schedule of compliance for new water quality-based ammonia limits has been deleted (see the revised draft permit at Part I.C).
- The schedules of compliance, including the interim milestones and the interim effluent limitations for phosphorus (which apply during the term of the compliance schedule) have been revised (see the revised draft permit at Part I.D).
- Surface water monitoring requirements have been changed (see the revised draft permit at part I.F).
    - o **See PCBs and 2,3,7,8 TCDD (dioxin) pg 2,3**

- The draft permit now requires more frequent effluent monitoring for whole effluent toxicity and total residual chlorine relative to the 2007 draft permit (see the revised draft permit at Parts I.B and I.E).
    - **See PCBs and 2,3,7,8 TCDD (dioxin) pg 2,3**
- In addition to more frequent monitoring, the draft permit includes additional requirements for whole effluent toxicity testing (e.g. accelerated testing, toxicity reduction evaluation) to ensure consistency with EPA guidance (see the revised draft permit at Part I.E).
    - **Whole Effluent Toxcity, pg 4**
- The permit now includes influent and effluent monitoring requirements for 2,3,7,8 tetrachlorodibenzo-p-dioxin (2,3,7,8 TCDD) (see the revised draft permit at Parts I.B and II.I).
    - **See PCBs and 2,3,7,8 TCDD (dioxin) pg 1-4**
- The phosphorus management plan requirements have been changed (see the revised draft permit at Part II.B).
- The permit now includes best management practices requirements intended to reduce the discharge of polychlorinated biphenyls (PCBs) and 2,3,7,8 TCDD (see the revised draft permit at Part II.I).
    - **See PCBs and 2,3,7,8 TCDD (dioxin) pg 1-4 and Biodegradation of PCBs pg 4-6**
- The permit now requires the permittee to participate in the Spokane River Regional Toxics Task Force (see the revised draft permit at Part II.H).

Coeur d'Alene POTW only:

- The compliance evaluation level for total residual chlorine effluent limits has been changed from 100 µg/L to 50 µg/L.

Post Falls and Hayden POTWs only:

- The draft permit no longer contains a compliance evaluation level for total residual chlorine effluent limits.

Post Falls POTW only:

- Effluent limits and monitoring requirements for chlorine now apply only when chlorine is used for disinfection or elsewhere in the treatment process.

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